February 4, 2008

M E M O R A N D U M

To: Mark Mason, P.E.
Engineering Manager, Boise Regional Office

From: Valerie Greear, E.I.T.
Associate Engineer, Boise Regional Office

Subject: **Staff Analysis of Skyline 1 Corporation (Skycliff Planned Development) Wastewater Reuse Permit, LA-000209-01 (Municipal Wastewater)**

Purpose

The purpose of this memorandum is to satisfy the requirements of the *Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater* (Rules), IDAPA 58.01.17.400.04, for issuing wastewater reuse permits. This memorandum addresses Draft Permit No. LA-000209-01, for the private municipal wastewater treatment and reuse system of Skycliff Planned Development, owned and to be operated by Skyline 1 Corporation, hereafter referred to as Skycliff or the permittee.

Summary of Events

Skyline 1 Corporation has proposed a development in east Boise, northeast of the intersection between Highway 21 and Warm Springs Road, called Skycliff Planned Development. Civil Survey Consultants, Inc. prepared the Preliminary Engineering Report and Reuse Permit Application for the project.

Following a pre-application meeting held on January 31, 2006, the first draft of the Wastewater Reclamation and Reuse Permit Application was received by DEQ on May 1, 2006. Review of the first draft by Paul Wakagawa, formerly of DEQ, led to changing the treatment plan from Class B to Class A effluent, and an amended application was received on October 3, 2006. A final revised application was received on August 14, 2007.

The geologic assessment and hydrogeologic impact analysis was conducted by STRATA, Inc. A memorandum presenting aquifer test results was received on March 2, 2007, and Dennis Owsley, formerly of DEQ, provided comments. As a result of these comments, a fourth exploratory well was drilled, and an Aquifer Parameters report was received by DEQ on April 23, 2007. Following a meeting on May 4, 2007 in which representatives of DEQ, STRATA, Inc., Civil Survey Consultants, Inc., and Skyline I Corp. were in attendance, the Nutrient Pathogen Evaluation was finalized and received by DEQ on May 22, 2007. An addendum to the NP Evaluation reflecting changes in design flows was received on August 1, 2007.

The plans and specifications for the treatment plant were prepared by AQUA Engineering, received on October 23, 2006, and approved by Mark Mason of DEQ on March 21, 2007.

In addition, the permittee has applied for a National Pollutant Discharge Elimination System (NPDES) permit to discharge effluent to the Boise River during the non-growing season (NGS). The application was first submitted on May 20, 2005, and revised on December 14, 2006. The Environmental Protection Agency (EPA) has not been able to issue an NPDES permit for Skycliff because a Total Maximum Daily Load (TMDL) allocation for phosphorus in the Boise River has not been established. While the permittee hopes to eventually have the option of discharging to the Boise River, the site is designed to handle NGS hydraulic loading via ground water recharge.

The Permit Application and Engineering Report submitted by Civil Survey Consultants, Inc., the Nutrient Pathogen Evaluation submitted by STRATA, Inc., the Treatment Plant Plans and Specifications submitted by AQUA Engineering, Inc. and other supplemental information provided by the permittee were used to develop Draft Permit No. LA-000209-01 for a public review and comment period. After the public review period is closed, DEQ will provide written responses to all relevant comments and prepare a final permit for Skyline 1 Corporation for the wastewater reuse facilities at Skycliff Planned Development.

Site and Process Description

Skycliff is a proposed planned community development located northeast of the Warm Springs Road and Highway 21 intersection. Refer to Appendix 2, Site Map No. 1 of the draft permit for an aerial photograph showing a superimposed boundary line of the Skycliff property, which totals approximately 700 acres. The Skycliff development will ultimately have approximately 1500 connections, which includes homes, a grade school, a post office and other community support facilities. Figure 2 attached to this document shows the development plan at build out, with the North Village to be built out first, followed by the Central Village and then the South Village. The permittee estimates that 150 equivalent dwelling units (EDUs) will be added each year of development, for 10 years. Thus, the permittee has planned for the occupation of approximately 750 EDUs during the 5 year duration of the proposed permit.

Plant Treatment

Wastewater generated on site will be municipal, and will be treated to Class A effluent standards via a Membrane Bio-Reactor (MBR) consisting of primary and secondary treatment (screening, then anaerobic and aerobic biodegradation) followed by membrane filtration and finally ultra-violet (UV) disinfection. The treated wastewater will be used to irrigate community areas, fire/wildlife buffer zones, and re-vegetation areas. It will also percolate to ground water via a series of unlined channels, wetlands, and ponds. The development will be built in phases over 10 years, adding additional land treatment capacity with each phase. The draft permit covers the first 5 years of the development plan.

The MBR is designed to ultimately treat 570,000 gallons per day, but capacity will be brought online in phases as needed. A capacity of approximately 225,000 gpd is expected to be in use by the end of this permit term. There will be two separate and redundant treatment trains. Sludge will be the only solid generated, and will either be land filled or taken to the City of Meridian for further reduction.

The redundant capacity requirement of IDAPA 58.01.17.601.07 will be fulfilled by the treatment plant being completely capable of treating peak day flow in each train individually. In addition, there are two each anoxic basins, aeration basins, and membrane basins, each of which can be individually taken off line. The capacity of all equipment is shown in the following table.

Table 1: Treatment Plant Capacity

Treatment		Capacity	Number of Units Online per Train
Primary	Influent Screens	1.2 mgd	2
Secondary	Biological Treatment	0.8 mgd	2
Tertiary	Membrane Treatment[b]	150,000 gal/day/train[a]	3 Cassettes
Disinfection	UV Disinfection	1.2 mgd	2
Ancillary Equipment	Permeate Pumps	0.6 mgd	2
	Air Blowers	1600 scfm[c]	3

a. Capacity is based on 25,000 gal/cassette average day flow and 50,000 gal/cassette peak day flow.
b. Kubota Type 510 cassettes with a peak flux rate capacity of 24.6 gfd (gallons per square foot per day) are to be used, with the design flux rate being 12.3 gfd. The filters are rated to a maximum of 40 gfd at -5 psi. Each cassette has a surface area of 1,720 ft^2.
c. Required air for first phase is 2,011 scfm.

For the first phase of development, three membrane cassettes will be installed in each treatment train. As development proceeds, and additional capacity is necessary, more membrane cassettes will be added, up to a capacity of 285,000 gpd. After that, an additional permeate pump, permeate piping, reuse pump, and blower will have to be installed. As built, the treatment plant can handle up to 570,000 gpd. At 5 years, the length of this draft permit, the development is predicted to have housing available to produce an average daily flow of 225,000 gpd, and at the 10 year build out the average daily flow is predicted to be 450,000 gpd.

Effluent Reuse

A pressurized pipeline will run from the treatment plant to the ground water recharge area with irrigation lines branching out from the main line. The following is a description of the reuse areas; for reference, see Figures 2 and 3 attached to this document.

Ponds:

A series of two reuse ponds will be constructed using on-site clay loam materials. The upper pond functions as a flow equalization and distribution pond and will have 0.5 acres of surface area and hold 1 million gallons. Excess effluent from the upper pond will flow by gravity over a weir and through a pipeline to the lower pond, referred to in drawings as the landscape/storage pond. This lower pond will have 1.2 acres of surface area and hold 7.5 million gallons. Excess effluent from this pond will flow by gravity over a weir and through a riparian channel to a third pond. This final basin, referred to as a landscape dry basin or the stormwater retention basin, has a volume of 15 acre-feet and is banked on the lower side by a roadway embankment. It is included as a safety measure for heavy rain events, snow melt, and will most likely remain dry except after heavy rains.

Riparian Channel:

Approximately 2.25 acres of surface area will be constructed wetland basins and riparian channels to provide final percolation, uptake and evaporation. The riparian channels will be constructed in phases, the westerly section in Figure 3 (attached to this document) first, with a proposed 1 acre of surface area, and then the easterly section (approximately 1.25 acres of surface area) as capacity is needed.

Homeowner Association (HOA) Lawn Areas:

A total of 28 acres of community areas with turf grass and landscaping will be irrigated with reuse water based on irrigation water requirements (IWR) using pressure irrigation. During this permit phase however, only the North Village sections, 5.3 acres, will be in use. The following is a list of the reuse sites and their sizes.

- North Village Windmill Park – 1.4 Acres
- North Village Parks – 1.9 Acres
- North Village Roundabout Park – 1.1 Acres
- North Village Longreach Park – 0.9 Acres
- Central Village School Site – 10.0 Acres
- Central Village Park Sites – 3.1 Acres
- Boulevard Park Site – 4.3 Acres
- South Village Park Site – 5.4 Acres

Residential lawns will not be irrigated with reclaimed water at Skycliff.

Wildlife/Fire Buffer:

The wildlife/fire buffer will be a green strip approximately 50 feet wide along the perimeter of the developed area, to buffer the development from undeveloped open areas. This buffer strip will be a total of approximately 40 acres of sprinkler irrigated turf and landscape area at build-out, with 25 acres anticipated by the end of the proposed permit term.

Re-vegetation of Open Space:

Beginning the second year, ten acres of open area will be re-vegetated with native plants. The area will be irrigated with up to 2 in/mo of reclaimed effluent for two years to supplement precipitation in the re-vegetation effort. Each year following the second year of development, ten acres will be added and ten acres removed from being irrigated with reclaimed water until a total of 100 acres have been re-vegetated. After the 10^{th} year, at build-out, reclaimed wastewater will no longer be used to supplement precipitation this open area.

The following table shows the development plan acreage for the increasing effluent flow and the simultaneous increase in reuse areas over the life of the development.

Table 2: Effluent Reuse Phased Development Plan

Phase (Year)	Predicted Average Daily Flow	Storage Pond	Riparian Channel	HOA Lawn	Wildlife/ Fire Buffer	Wildlife Enhancement
	gal/day	Total Acres				
1	45,000	0.5	0.18	1.4	4	0
5	225,000	0.5	1	5.3	25	20
10	450,000	1.7	2.11	28	40	0

Water Balance

A water balance for Skycliff included in the permit application provides estimates of how much effluent will be produced and where it will be utilized. The following table shows the water balance estimated for the first, fifth, and final year of development.

Table 3: Water Balance

				Infiltration and Evaporation Losses		Irrigation			
Phase/Year	Acres of infiltration	Acres of Irrigation	Influent	Storage Ponds	Riparian Channel	HOA Lawn[a]	Wildlife Enhancement[b]	Wildlife/Fire Buffer[c]	NPDES Discharge to Boise River
	Acres		MG/yr						
1	0.68	5.4	8.9	0	7.8	1.2	0	0	0
5	1.5	50.3	74.6	27.9	14.6	6.8	8.9	10.2	0
10	3.81	68	156.8	42.4	31.0	27.7	0	20.4	0

a Irrigated at Irrigation Water Requirement (IWR)
b Irrigated at 2 inches/month
c Irrigated at 40% of IWR

The infiltration rate for the ponds was estimated to be 0.25 in/day because the ponds are lined with clay and intended to hold water. The riparian area is intended to seep water at an estimated rate of 7.2 in/day, which is discussed in the next section. The actual seepage rates will be verified as development proceeds.

Evaporation losses are included and are based on a University of Idaho study, "Monthly Shallow Pond Evaporation in Idaho", Monau & Kpodrze, and the Climatological Handbook – Columbia Basin States, Precipitation Vol. 2. Irrigation will occur during the growing season of March 1 to October 31, and will be 2 in/mo for the wildlife enhancement revegetation area, Irrigation Water Requirement (IWR) for the HOA lawns, and 40% of IWR for the wildlife/fire buffer zone.

Environmental Discussion

Soils

The site proposed for the Skycliff planned development is located in the foothills near the intersection of Highway 21 and Warm Springs Ave, above the columnar basalt cliffs visible along Highway 21. The site is currently and historically undeveloped and has been used for recreation and some livestock grazing.

According to The Soil Survey of Ada County, soils in the areas to be developed are primarily Ada gravelly sandy loam and Brent loam of varying slopes. There are also some sections listed as Power silt loam, Casmere coarse sandy loam, and Tenmile very gravelly loam in the development site. Other soils are present in portions of the site which will not be developed, and not irrigated

except potentially for a 2 year period during revegetation (see previous section).

Eleven exploratory test pits were excavated on January 29 and 30, 2007. Infiltration tests were conducted in the pits, shown in Table 4. The pits were dug in the vicinity of a no longer current placement plan of the recharge basins. Due to several factors, not related to soils or infiltration, the pond placement will now be to the west of where the pits were dug. Therefore, the soils and infiltration rates shown in the following table do not necessarily reflect the conditions where the basins will be. However, the terrain is similar and close to where the pits were dug, and expected to adequately represent the area.

Table 4: Soil Test Results

			Infiltration Rate In/Hr	Test Depth Ft	Recommended Design Infiltration Rate In/Hr
Primary Pond*	East-Facing Slope	Clayey Sand with Gravel	2.72	2	1.0
		Sandy Clay with Gravel	0.15	2	0.1
		Poorly-Graded Gravel with Sand	82.5 71.3	8	20
	West-Facing Slope	Poorly-graded Gravel with Sand and Clay	0.85	8	0.5
		Sandy Clay	0.26	10	0.1
Secondary Pond*	East-Facing Slope	Poorly-graded Gravel with Sand and Silt	0.36	8	0.1
	West-Facing Slope	Lean Clay with Sand	1.3 1.13	2	0.3

*Primary and secondary pond designation is from a now outdated plan, not the current pond location plan.

The upper and lower basins will be lined with native clays, retarding infiltration. An infiltration rate of 0.25 in/day was used by the engineer in the water balance, reflecting typical lined pond seepage rates. The permittee's desire is for water to be in these ponds at all times for aesthetic and equalization purposes. Infiltration will be accomplished in the lower, unlined, riparian area, providing the final effluent disposal.

Infiltration values used in the water balance design for the riparian area are based on the Recommended Design Infiltration Rates, supplied by STRATA, Inc., in the above table. The infiltration value used for the riparian area is 0.3 in/hr, or 7.2 in/day, based on the upper recommended infiltration value for the secondary pond, which is nearest to the future location of the wetland area. Because the wetland ponds and channels will be constructed over time, the sizes and locations of the ponds will be determined based on the infiltration rates observed. See Figure 3 attached to this document for the pond and riparian area plan.

Ground Water

The effect of recharge at the Skycliff planned development on ground water is considered the most complicated environmental concern due to the lack of understanding about the geology within the site boundaries. STRATA, Inc. was retained by the permittee to conduct the hydrogeological evaluation and impact analysis, which was presented in the Level 2 Nutrient-Pathogen Evaluation, dated May 18, 2007, hereafter referred to as the NP Evaluation. Four well borings and multiple exploratory test pits were utilized to characterize the subsurface. A confined aquifer was found at depths greater than 300 ft below ground surface (bgs), flowing in a general southwesterly direction.

Four well borings were drilled in the vicinity of the recharge basins to characterize the subsurface (see Figure 4 in attached). The well borings were lined with steel casings and screened at the bottom, and were terminated at 150, 363, 393, and 366 ft bgs. The shallowest well was drilled first, and upon conducting a pumping test, the well was determined to have been screened in a perched aquifer. The last well (366 ft bgs) was completed with PVC and not screened.

Analysis of the borings in the NP Evaluation indicated that the site geology is generally comprised of alluvial fan gravels which overlie basalt, gravels, older alluvial sediments, and overlie or are adjacent to volcanic-derived sediments and basalts. The gravel layers encountered were generally cemented and contain intermittent clay layers. Ground water was not found in the elevated gravel layers which overlie basalt, interpreted as basalt of Gowen Terrace.

Found below the basalt of Gowen Terrace was a small layer of weathered basalt and fine-grained soil, below which ground water was encountered. The small layer was interpreted as the confining or leaky confining layer. Figures 4 and 5 attached to this document are maps provided by STRATA, Inc. in the NP Evaluation. Figure 4 is the reference map for the cross section, and Figure 5 is the basic illustrative interpretation of the cross section based on what was found in field work and review.

In the NP evaluation, the interpretation is that the confining layer continues under the Boise River, and therefore ground water flows beneath the Boise River and towards the Snake River. STRATA, Inc. did not find evidence of faulting.

Two scenarios were considered for effluent fate. The first is that it will seep to the aquifer through a leaky confining layer. The second is that the effluent will not seep to the aquifer, but will migrate through the vadose zone. If the effluent does not seep to the aquifer, there are three potentially negative possibilities: the first is nuisance water either daylighting from the cliffs along Highway 21 or in the form of wet yards, crawlspaces, or basements; the second is if migrating water were to affect the Brian Water Corporation community well in the neighboring subdivision; and the third is that the effluent would enter the Boise River. At DEQ's request, STRATA, Inc. performed evaluations of these potential effects.

Analysis 1: Aquifer recharge
One possibility for effluent transport and fate is to the main aquifer beneath the site. Ground water elevation of the confined aquifer within Skycliff's boundaries is estimated to be 2750-2800 ft above sea level, or 350-400 ft bgs. The hydraulic conductivity is estimated as 61 ft/day, the hydraulic gradient is 0.122 ft/ft, and the direction of flow is generally SW across the site, towards the Boise River. STRATA, Inc. conducted a Level 1 NP Evaluation mass-balance around nitrate in the aquifer, and found that the predicted average nitrate concentration would be 2.0 mg/L, which is a 0.3 mg/L increase of background concentration. For reuse projects, DEQ generally considers ground water nitrate concentration increases of no more than 1 mg/L to be compliant with the Ground Water Rules, IDAPA 58.01.11.

Analysis 2: Daylighting or Nuisance Water
If effluent does not infiltrate through the confining layer and mix with ground water, there is a concern that the effluent could daylight between the site and Highway 21. In the NP Evaluation, STRATA, Inc. concludes that based on the visible geology, effluent will not daylight adjacent to Highway 21. However, **DEQ recommends that the permittee report any nuisance water or daylighting event at any point along the cliffs between the site and Highway 21 or Warm Springs Road.** Events are required to be reported orally immediately when they are discovered, and an investigation of what caused the nuisance water or daylighting event and any necessary corrective actions should be included in a follow-up letter to DEQ. **In addition, DEQ recommends that the permittee keep a log of all nuisance water complaints by residents of flooded basements or crawlspaces, or wet yards, and any follow-up actions taken.** This log is recommended in the Draft Permit to be submitted each year with the Annual Report.

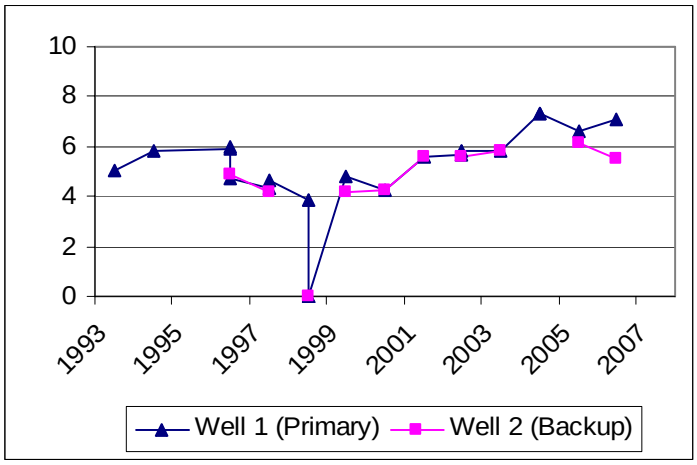
Analysis 3: Impact to Neighboring Well
An analysis was conducted to evaluate the potential for, and effect of, recharge water impacting the neighboring Brian Water Corporation community well, hereafter the Brian Well. The Brian Well, labeled as 1-2 in Figure 4 attached to this document (and shown in Appendix 2, Site Map No. 3 of the draft permit), is approximately 5000 ft northwest of the recharge basins. A mostly theoretical analysis to estimate impact to the Brian Well was completed using a Level 1 NP analysis. The characteristics of the aquifer tapped by the Brian Well were estimated using pumping data and the well log for this well, and the research conducted at the Boise Hydrogeophysical Research Site located near the site.

The background nitrate concentration at the Brian Well used in the analysis was 6.6 mg/L, from a sample taken on July 19, 2005. The nitrate concentration of the effluent was assumed to be 10 mg/L. It was assumed that 13% of the total effluent flow (which is 40,959 gal/day) would reach the Brian Well service area, which was taken as 1320 feet wide by 15 feet deep, and an area of 25 acres. See the NP Evaluation for a more detailed description of the analysis.

The NP Evaluation mass balance around the Brian Well aquifer resulted in an average nitrate concentration of 7.2 mg/L in groundwater, a rise of 0.6 mg/L. In general, an increase of less than 1 mg/L nitrate in the aquifer at the property boundary is considered an acceptable impact.

The results of annual nitrate sampling from the primary and backup Brian Water Corporation community wells are shown in the following plot. The drinking water Maximum Contaminant Level (MCL) for nitrate is 10 mg/L, which is the maximum permissible level of nitrate in water delivered to any user of a public water system.

Figure 1: Nitrate Concentration at the Brian Water Corporation Community Well



Under the conservative approach taken by STRATA, Inc. in analyzing the risk to the Brian Well, 0.6 mg/L nitrate concentration increase is compliant with DEQ's reuse impact rules. **Therefore, it is not recommended that the permittee be required to conduct additional monitoring of the Brian Water Corporation community well at this time.** In the permit renewal process, which is addressed in Compliance Agreement CA-209-07 of the draft permit, it is required that the hydrogeologic analysis be revisited in light of all data collected at the site to assess the accuracy of the analysis and any affect the site has had on groundwater. This includes the drinking water contaminant sample data collected annually from the Brian Well in accordance to the DEQ community drinking water well sample program.

Analysis 4: Mixing with Boise River

A final concern if effluent does not mix with the regional aquifer is that it could directly enter the Boise River with no previous mixing, by migrating above the confining layer. STRATA, Inc. did a phosphate and nitrate mass balance mixing evaluation, which is discussed in the following section, titled Surface Water.

Conclusions

Permit limits for nitrate concentration in wastewater effluent are generally based on impact to ground water. In the cases described above, it was shown that a nitrate concentration of 10 mg/L is protective of ground water. Therefore, **DEQ recommends that nitrate concentration in effluent be limited to 10 mg/L**, the maximum nitrate concentration allowed for direct ground water recharge.

Due to the theoretical nature of the hydrogeological evaluation, **DEQ recommends that a monitoring well be drilled near the recharge basins** in an effort to provide actual information on the affect that the development has on the subsurface. The monitoring well location has been planned in a location SW of the recharge basin, placing it between the recharge basins and both the Boise River and the Brian Water Corporation Well. It is planned to drill the well to the basalt of Gowen Terrace, with the actual termination to be determined during drilling. In following sections, monitoring and subsequent analysis of the data collected from this monitoring well is discussed.

Surface Water

The Boise River is located south and west of Skycliff, separated by Warm Springs Avenue and Highway 21, respectively. There are several drainages across the site, as can be seen in the FEMA flood map included in Appendix 2, Site Map No. 3 of the draft permit. These drainages, or ephemeral streams, are connected to the Boise River via a culvert under Highway 21 and are thus considered waters of the United States. Therefore, effluent cannot be allowed to mix with any storm water in these drainages.

According to the permit application, the easterly drainage has a contributing area of 12 acres, and the westerly drainage has a contributing area of approximately 52 acres. Surface runoff in the vicinity of the reuse basins will be diverted around the basins and into the riparian area for infiltration. Because reuse water will also be used for irrigation, some runoff into storm drains is expected as with any sprinkler irrigation. The permittee will invoke Best Management Practices (BMPs) to prevent this from occurring to the extent possible.

The permittee has applied to EPA for an NPDES discharge permit to the Boise River in addition to the reuse permit. An estimate of when a discharge permit will be issued cannot be made, because it depends on when an agreement of the Total Maximum Daily Load (TMDL) allocation for that section of the Boise River can be reached. Therefore, the permittee has designed the reuse water application site such that non-growing season discharge is not necessary.

DEQ requested that in addition to assessing the impact of recharge water on the confined aquifer, the permittee should conduct an impact analysis of recharge water on the Boise River for the scenario of reuse water traveling through the subsurface and entering the Boise River with no prior mixing. STRATA, Inc. performed this analysis in the form of a Nutrient-Pathogen mass balance calculation. It should be noted however that their analysis of ground water flow showed that the Boise River is a losing stream in the section in question, above the diversion dam.

The scenario of effluent mixing directly with the Boise River with no prior mixing is considered possible in the subsurface geology cross section shown in Figure 4 attached to this document. If recharge water were to travel in the vadose, or unsaturated, zone labeled as QTtg/Qag in Figure 4, it could potentially mix directly with the water of the Boise River. STRATA, Inc. conducted a Nutrient-Pathogen (NP) analysis, dated May 18, 2007 with an addendum dated August 1, 2007, which analyzed the impact of nitrate and phosphorus in effluent on the Boise River. In this analysis, all effluent was assumed to enter the Boise River with no previous mixing. The Boise River flow was considered to be 181 cfs, which is the 10-year low as measured at the Glenwood Bridge. The evaluation stated that the Boise River has a low mean flow value of 332 cfs, and an annual mean value of 1,270 cfs, so analysis using 181 cfs is considered conservative. The background concentrations used for the Boise River were 0.02 mg/L phosphate and 0.04 mg/L nitrate as measured on September 21, 2004 by the USGS at the diversion dam near the site.

Assuming that all effluent terminates at the river with no prior mixing, STRATA, Inc. conducted a mass balance around nitrate and phosphorus. Background concentrations used were taken from the most recent USGS sampling available, September 21, 2004, at the diversion dam. The flow rate used was the 10 year low as measured at the Glenwood Bridge, which was recorded in 2001. The mass balances around nitrate and phosphorus for the Boise River are presented in the following table.

Table 5: Nutrient Mass Balance around the Boise River

	Reuse Water		Boise River		
	Effluent Concentration	Flow Rate	Background Concentration[a]	Flow Rate[b]	Final Concentration
Nitrate	10 mg/L	0.315 MG/day	0.04 mg/L	117 MG/day	0.07 mg/L
Phosphorus	0.4 mg/L		0.02 mg/L		0.02 mg/L

[a] Data collected by the USGS on September 21, 2001, at the Diversion Dam
[b] Data collected by the USGS in 2001 at the Glenwood Bridge

As can be seen in the previous table, the analysis for phosphorus impact, with a concentration of 0.4 mg/L in the effluent, showed negligible impact. There is no surface water standard for nitrate in Idaho; therefore nitrate impact on the Boise River is secondary to the impact on ground water discussed in the previous section.

Surface water quality dictates acceptable phosphorus concentrations, which is the limiting nutrient contaminant in the Boise River. As discussed previously, a TMDL for the Boise River in this area has not been written, but it is anticipated that allowable phosphorus loading in surface discharge will be very low.

The hydrologic unit code (HUC) for the Lower Boise River Subbasin is 17050114, and the section between Lucky Peak Dam and the Diversion Dam is Unit SW-11b, as listed in the Water Quality Standards, IDAPA 58.01.02.140.12. The aquatic designation is cold; the recreation designation is Primary Contact Recreation; and it is additionally a Drinking Water Source and a Special Resource Water (SRW). The SRW designation means that intensive protection of the quality of this water is necessary.

In the opinion of DEQ, the NP Evaluation and related submittals did not adequately resolve where effluent will migrate through the subsurface. There is a real possibility that the majority of effluent will terminate, without prior mixing, in the Boise River. In previous cases similar to this, where a direct link between effluent recharge and the Boise River is likely, the phosphorus concentration limit in recharging effluent has been limited to the anticipated phosphorus loading limit in drafts of the TMDL for the Lower Boise River. Currently the proposed phosphorus limit for wastewater treatment plant outfalls is 0.2 mg/L. Although effluent will be land treated as the water seeps through the subsurface and phosphorus is taken up by adsorption, there will eventually be breakthrough as the phosphorus adsorption capacity is reached. Because of the importance of protecting the health of the Boise River, **DEQ recommends that the phosphorus concentration in the effluent be limited to 0.2 mg/L. In addition, a provision in the draft permit provides that this limit may be altered to reflect the loading limit laid forth in the finalized TMDL.**

Discussion of Permit Conditions

The Idaho Rules for Reclamation & Reuse of Municipal & Industrial Wastewater, IDAPA 58.01.17, hereafter the Rules, contains specific monitoring and effluent concentration requirements for Class A systems. Many of these requirements are outlined specifically in the permit, but all applicable rules must be adhered to. The following sections discuss some of the proposed permit conditions.

Constituent Concentration Limits

The permit application states that influent concentrations are anticipated to be 300 mg/L BOD_5 (5-day Biochemical Oxygen Demand), 250 mg/L TSS (Total Suspended Solids), and 35 mg/L TKN (Total Kjeldahl Nitrogen). Proposed effluent concentration limits are shown in the following table.

Table 6: Proposed Effluent Concentration Limits

	Proposed Effluent Concentration Limits
BOD_5	5 mg/L
Total Nitrogen	10 mg/L
Total Phosphorus	0.2 mg/L
Turbidity	0.2 NTU
pH	6-9

The Class A waste water reuse Rules, IDAPA 58.01.17.601, provide maximum allowable effluent concentrations for BOD_5, Total Nitrogen, and Turbidity. Because effluent for irrigation is not separated from effluent for recharge, the proposed effluent constituent limits reflect the lower concentration limits for recharge from the Rules. Therefore, BOD_5 shall not exceed 5 mg/L based on a monthly arithmetic mean as determined from weekly composite sampling. The maximum Total Nitrogen is proposed to be 10 mg/L; for further information about Total Nitrogen limits, see the Ground Water section of this document.

When necessary, a Total Phosphorus limit is imposed in addition to the aforementioned constituents. For this site, a limit of 0.2 mg/L Total Phosphorus is proposed; a discussion of this is found in the Surface Water section of this document. In addition, pH is to be kept between 6.0 and 9.0 as determined by daily grab samples or continuous monitoring. These constituents shall be monitored at a point of compliance following disinfection and prior to distribution.

An in-line continuously monitoring and recording turbidimeter is required for each treatment train after filtration and prior to disinfection. Because this is a membrane filtration system, the daily arithmetic mean of all daily measurements of turbidity shall not exceed 0.2 NTU (Nephelometric Turbidity Unit), and shall not exceed 0.5 NTU at any one time. If turbidity ever does measure over 0.5 NTU for 5 consecutive minutes, the treatment train must be taken offline and effluent treated in accordance with the redundant capabilities of the treatment plant (see the Plant Treatment section of this document).

The nutrient concentration limits imposed in the draft permit are considered to be protective of public health and the environment when applied in accordance with the Rules and the site operation conditions of the permit (see the Compliance Activity section of this document). Therefore, **nutrient and hydraulic loading requirements in addition to effluent concentration limits are not recommended for inclusion in the Reuse Permit for Skycliff.**

Disinfection

The proposed permit includes disinfection limits as set out in the Rules. This permit limit is written as follows: “the median number of total coliform organisms shall not exceed 2.2 CFU/100mL [Colony Forming Units per 100 mL] and shall not exceed 23 CFU/100 mL in any confirmed sample, as determined from the bacteriological results of the last 7 days for which the analysis has been completed”. The monitoring section of the permit requires that coliform be

sampled daily at a point of compliance following disinfection and prior to distribution. An accepted UV disinfection process will be installed to meet this and the 5-log viral inactivation requirement in the Rules. Class A wastewater is not required to be chlorinated when UV disinfection is utilized.

The UV disinfection system shall be operated in accordance with the manufacturer recommendations at all times. If at any time the treatment facility does not meet disinfection requirements, influent shall be directed to the other treatment train, and effluent from the downed train will be routed back to the operable treatment trains to be retreated prior to discharge.

Monitoring and Reporting

There are three monitoring sites proposed in the draft permit. Turbidity is to be measured at WW-1, an effluent monitoring location after the final filtration and prior to disinfection, in accordance with the Rules, IDAPA 58.01.17.601.06. A second point of compliance is after disinfection, WW-2. The following is proposed for monitoring at WW-2: effluent flow rate, grab sample for Total Coliform, grab sample or continuous monitoring of pH, and a weekly composite sample for BOD_5, Total Nitrogen, Total Phosphorus, and TSS. In addition, flow of effluent to irrigation shall be monitored and recorded. All flow measurement locations should be calibrated annually, and backflow testing shall be conducted at all supplemental water irrigation pumps that are directly connected to the wastewater distribution system.

Calculation of the volume of water and available storage capacity in the retention basins is proposed to be conducted monthly. Monthly calculation of the overall seepage and evaporation rate (overall water loss) from the ponds and riparian zones is also proposed. The acreage of riparian area and irrigation areas in use is proposed to be reported annually in the annual report submitted to DEQ, due May 31 of each year for the preceding calendar year.

A monitoring well is proposed in the draft permit (refer to the ground water section of this document). The draft permit contains a provision requiring that the following grab samples be taken from the monitoring well in April and October of each year: specific conductivity, TDS, Nitrite-Nitrate Nitrogen, and Total Phosphorus. In addition, monthly static water level measurements are proposed. The intent of this monitoring well is to provide some advanced warning if a potential for nuisance water arises due to the quantities of water being applied to the site. Nuisance water could show up in the form of wet yards, flooded basements or crawlspaces, or daylighting between the site and Highway 21. Any incident of daylighting is recommended to be reported orally to DEQ within 24 hours of discovery, and followed by a letter documenting the event and potential causes within 5 days of discovery. Records of public complaints of nuisance water on private property are to be kept in a log.

Discussion of the data collected from all monitoring sites shall be included in the Annual Report due to DEQ on May 31 of each year.

Buffer Zones

Signs warning the public of the source of the water in the recharge basin will be posted at all public access points. The warning signs will read “Warning: Reclaimed Wastewater – Do Not Drink” or equivalent in both Spanish and English.

In lieu of imposing buffer zones for the drainages and ephemeral streams at this site, prevention of contamination of waters of the state will be handled via rerouting, storm water collection, and

BMPs. The specific procedures and BMPs will be addressed in the Runoff Management Plan written by the permittee in accordance with Compliance Activity CA-209-04 of the proposed permit.

Compliance Activities

Site Management

General management of the site is addressed in the draft permit as Compliance Activities in Section E. The draft permit contains provisions requiring the permittee to submit to DEQ for review and approval a Plan of Operation, a Runoff Management Plan, and a Waste Solids Management Plan. Once approved, these plans will be included by reference into the permit and be an enforceable part of the permit.

The Plan of Operation, CA-209-01 of the proposed permit, is intended to be a comprehensive guide for the overall management and day-to-day operation of the site relevant to reuse water. The plan is expected to specifically address the requirements of the reuse permit in an operational guide manner. All sampling and monitoring procedures should be thoroughly addressed, and QA/QC procedures written out. The procedure for handling off-specification effluent and maintenance of the UV lamps to ensure that viral inactivation is being met should be specifically addressed. At a minimum, the design, operation, and maintenance procedures should be addressed for minimizing the potential for odors, anticipating the need for maintenance of the recharge basins, and the procedure for periods of shutdown and low flow. In addition, the Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater has a checklist in Appendix A.12 that should be used as a guide for developing the Plan of Operation. The proposed permit requires that the plan be submitted at or before 50% completion of the reuse facility construction, and an updated plan is due 60 days after the first complete year of operation.

Prior to the application of reuse water, the proposed permit requires that a Runoff Management Plan (CA-209-04) and a Waste Solids Management Plan (CA-209-05) be submitted for review and approval. These plans are required to ensure environmentally responsible management of the wastewater treatment plant. The Runoff Management Plan will address BMPs and other control structures designed to prevent runoff of reuse water to any property not owned by the permittee, or to ephemeral streams or drainages. The Waste Solids Management Plan will address how the permittee will handle and dispose of any solids generated by the treatment and reuse facilities.

In addition, CA-209-06 requires that in each Annual Report, the permittee submit proof that there is a certified Responsible Charge Operator and Substitute Responsible Charge operator for the treatment plant, as required in the Wastewater Rules, IDAPA 58.01.16.203. An application for permit renewal is due 6 months prior to expiration of the permit, and is included as CA-209-07. This compliance condition specifies that an updated hydrogeological assessment be included in the application, which incorporates all information collected during the permit term that may clarify the subsurface and effluent fate and transport on the site. This condition also requires that sample data taken from the Brian Water Corporation community well for drinking water compliance purposes be included in this analysis.

Plans and Specifications

Plans and specifications for irrigation piping are required by the draft permit as Compliance Activity No. CA-209-02. The plans need to show that the required separation distances between drinking water, wastewater, and reuse water pipes are met. The plans should also include any

exterior drinking fountains, picnic tables, food establishments, and other public eating facilities to ensure that they are placed out of the spray irrigation area where reuse water is used. All exposed and above ground piping, risers, fittings, pumps, valves, etc. used for reuse water should be painted purple, Pantone 512. And all reuse water piping needs to be identified using an accepted means of labeling reading "Warning: Reclaimed Water – Do Not Drink" in both Spanish and English lettering. In a fenced pump station area, signs need to be posted on the fence on all sides.

Recommendation

DEQ staff recommends issuance of the attached draft permit, LA-000209-01, Skyline 1 Corporation for the Skycliff Planned Development, for a 30 day public comment period. The draft permit addresses disinfection requirements, constituent concentrations, and wastewater treatment plant performance. Monitoring and reporting requirements to evaluate the system performance and to determine permit compliance have been specified. Compliance activities, as recommended in the staff analysis, are incorporated in Section E of the permit.

Figure 2: Skycliff Reuse Plan at Build Out

Source: Civil Survey Consultants, Inc., Reuse Permit Application, Figure 4 – Reuse Plan At Build Out

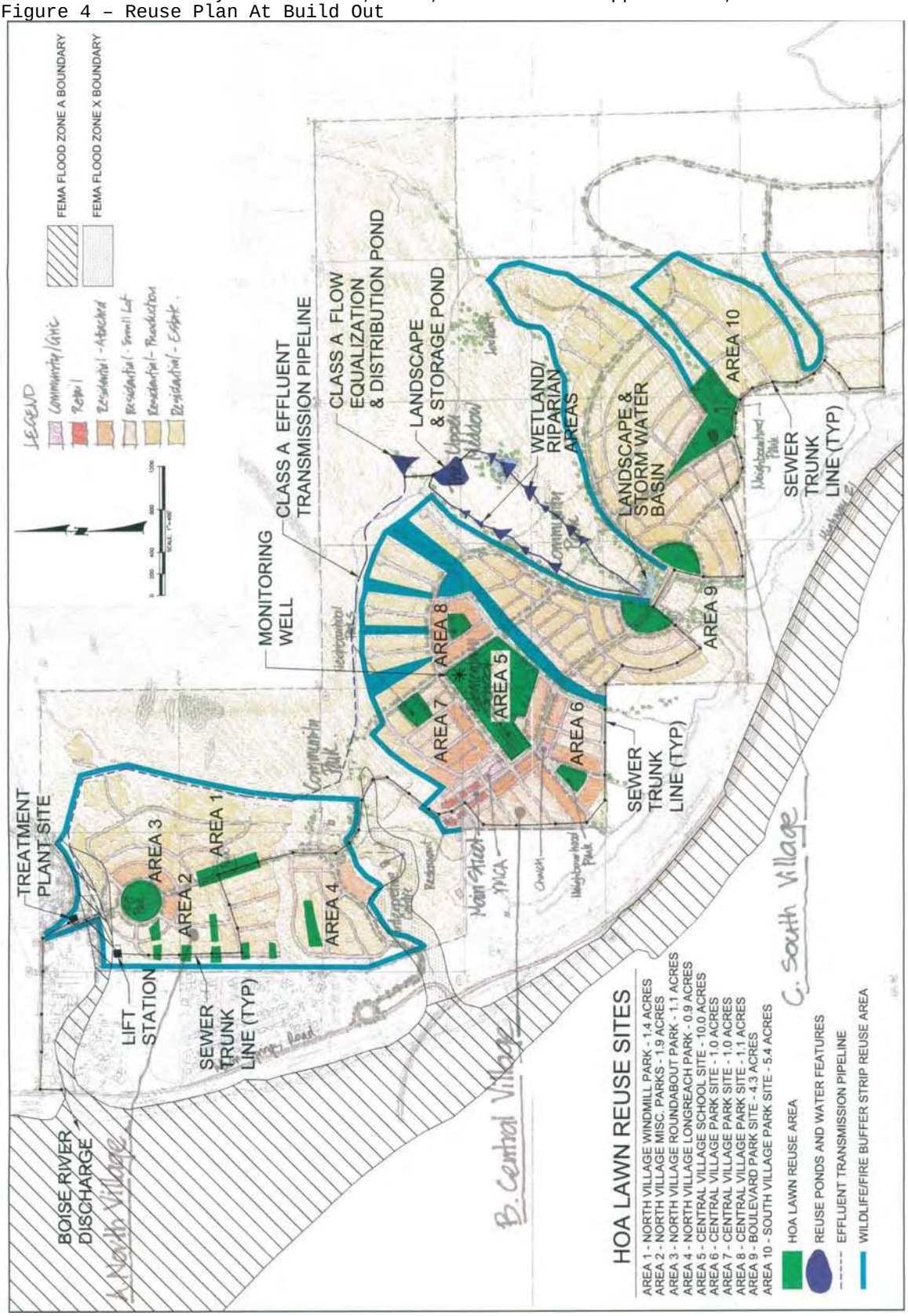


Figure 3: Close-up of Reuse Area at Skycliff

Source: Civil Survey Consultants, Inc., Reuse Permit Application, Figure 6 – Pond & Riparian Area Plan

Figure 4: Well Boring and Geologic Cross-Section Locator Map at Skycliff

Note: The proposed development was formerly called 'The Cliffs Planned Community'

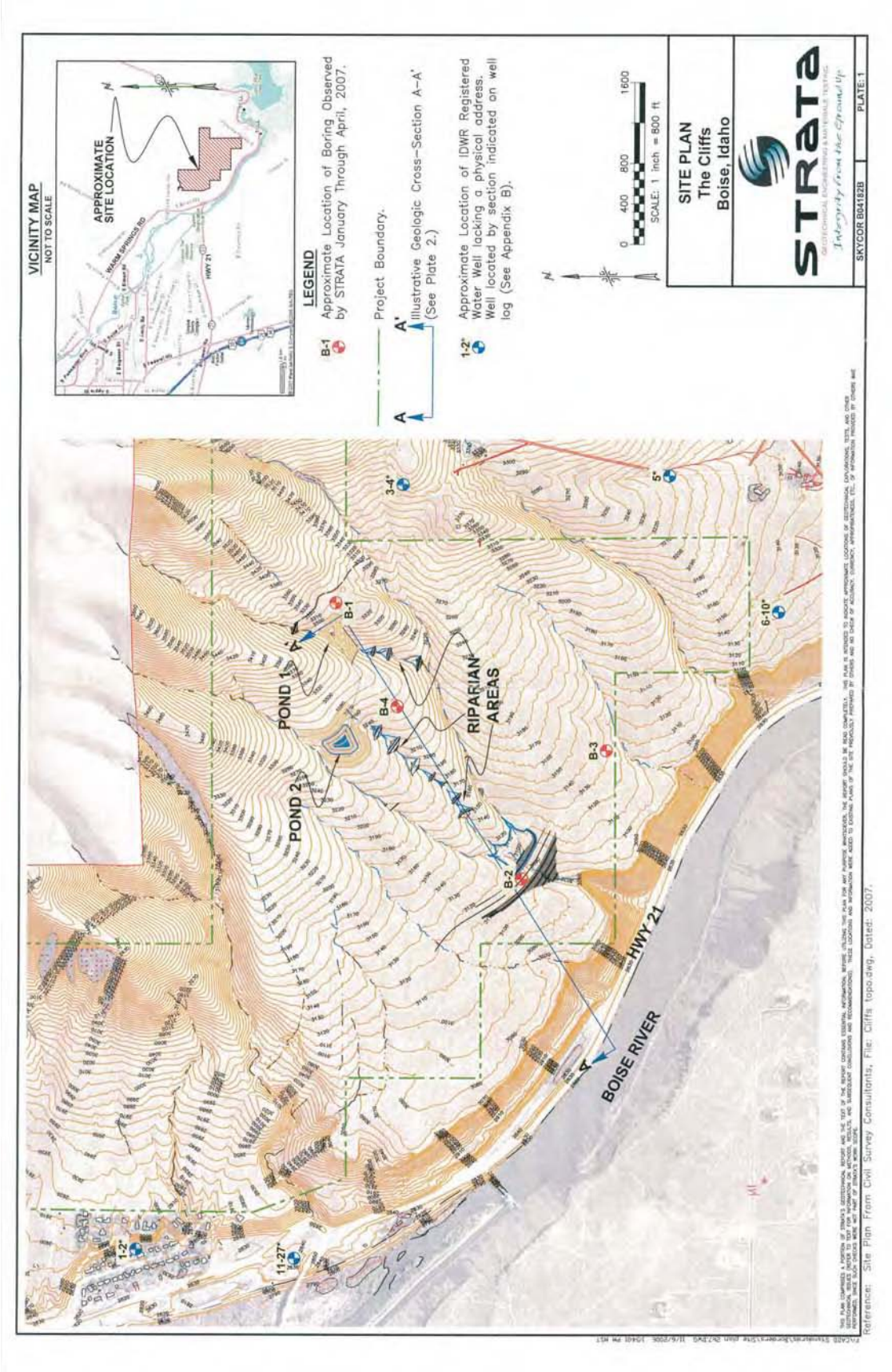


Figure 5: Geologic Cross-Section in Area of Recharge Basins at Skycliff

Note: The proposed development was formerly called 'The Cliffs Planned Community'